Recap Chapter 5
elastic forces (not in textbook)
next class: Universal Gravitation (Chapter 8.1)
Friday - group test
Tuesday Forces Test
Thursday start Momentum Chapter 9

Newton's 3 Laws
First - Law of Inertia
Objects stay at rest or in constant speed constant direction motion unless unbalanced forces act on them.
unbalanced forces is when the vector sum (include direction) doesn't add to zero.

F_{net} is the net force, is the sum of all forces.

if $F_{net} = 0$ then forces are balanced and a=0

Newton's Second Law: Law of acceleration
$F_{net} = ma$

Newton's Third Law: Action-Reaction Law
For every force object A acts on object B, object B responds with an equal and opposite force on A.

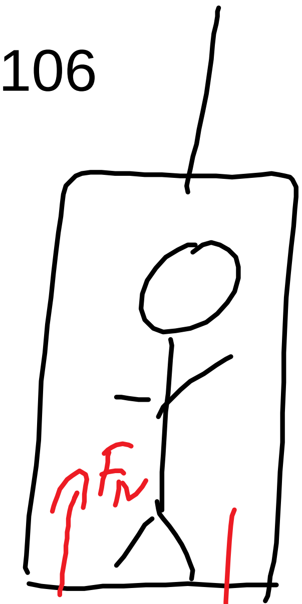
So, do they cancel out?

If you look at both objects as a system, it cancels

out.

If you look at each object individually, it doesn't.

Look at p106
Q20
Elevator:



$W = F_g = mg \quad g = 9.80 \frac{N}{kg}$

$$\boxed{F_{net} = ma = \sum F}$$

sum of all

F_N

$-F_g$

$ma = F_N - F_g$ *

direction

a) $836N = F_g$

$935N = F_N$

$ma = 935 - 836$

$ma = 99N$

$ma = 99\,N$

$836 = m \times 9.8\,\frac{N}{kg}$

$m = 85.3\,kg$

$a = \frac{99\,N}{85.3\,kg}$

$\boxed{a \doteq 1.2\,m/s^2}$

b) $\boxed{ma = F_N - F_g}$ *

$85.3a = 782 - 836$

$85.3\,kg\,a = -54\,N$

$\boxed{a = -0.63\,m/s^2}$

Lab Activity Elastic Forces

When you pull/push on an elastic band or a spring it changes the length, L.

The change in length is called the extension or compression, $x = \Delta L = L - L_o$ (original length)

Take a ruler, an elastic band (no stupid stuff) and a spring scale (force meter).

Pull the elastic band with the spring scale, record

the force - graph F (y-axis) and x (x-axis). get the equation

Table Elastic force

original L with no force

Force (N)	$x=L-L_o$ (cm)
0	0
	1.0
	2.0
	3.0
	4.0
	5.0
	6.0
	7.0
	8.0
	9.0
	10.0

graph and get the equation
be ready to share answers to p102-107 next class

Block 2-4
Recap Chapter 5
elastic forces (not in textbook)
next class: Universal Gravitation (Chapter 8.1)
Friday - group test

Tuesday Forces Test
Thursday start Momentum Chapter 9

Newton's 3 Law:

First Law - Law of Inertia

If there is no unbalanced force, or no force then the object stays at rest or stays at constant speed constant direction motion.

unbalanced forces is when the vector sum(include direction) is not zero

F_{net} is the vector sum of all the forces on an object.

$F_{net} = \sum F$

so if you pull a wooden block with 3.0N of force but friction is 2.0N the net force on the block is 3.0N-2.0N=$\boxed{1.0N}$

so the block would accelerate

Newton's Second Law - Law of Acceleration

$\boxed{F_{net} = ma}$

if the wooden block is 250g, what would be the acceleration if the net force is 1.0N?

acceleration if the net force is 1.0N?

$a = F_{net}/m = 1.0N/0.25kg = \boxed{4.0m/s^2}$

mass must be in kg because $N = \boxed{kg}m/s^2$ by definition

Newton's Third Law - Action-reaction Law
If object A exerts a force on B, B responds with an equal and opposite force on A.

P106
Q20

$F_g = W = mg = m \times 9.80 \frac{N}{Kg}$

$$\boxed{F_{net} = ma = \Sigma F \begin{cases} F_N \\ F_g \end{cases}}$$

$$ma = F_N - F_g$$

direction

$$m = \frac{F_g}{g} = \frac{836\cancel{N}}{9.80\cancel{N}/kg} = 85.3kg$$

$g \quad 9.80\,N/kg$

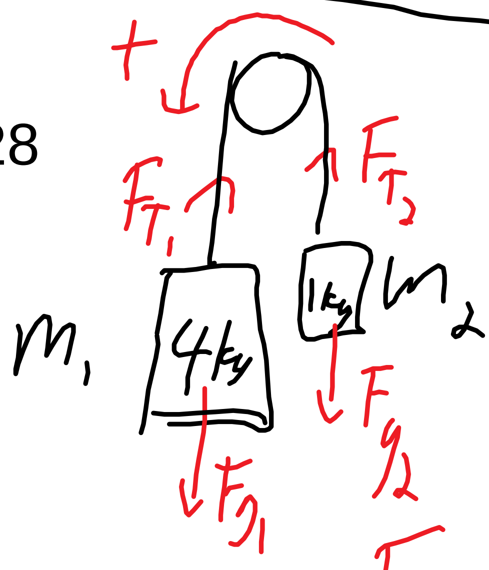
a) $85.3\,kg\, a = 935\,N - 836\,N$

$$a = \frac{99}{85.3} = \boxed{1.2\,m/s^2}$$

b) $85.3\,kg\, a = 782\,N - 836\,N$

$$\boxed{a = -0.63\,m/s^2}$$

p107 Q28



$$F_{g_1} + \cancel{F_{T_2} - F_{T_1}} - F_{g_2}$$

$$F_{net} = F_{g_1} - F_{g_2} = m a$$

Both masses

$$m_1 g - m_2 g = (m_1 + m_2) a$$

$$a = \frac{(m_1 - m_2)\, g}{}$$

$$a = \frac{(m_1 - m_2)\,g}{(m_1 + m_2)}$$

$$a = \frac{(4\,kg - 1\,kg)(9.80\,m/s^2)}{(4\,kg + 1\,kg)}$$

$$\boxed{a = 5.88\,m/s^2}$$

Tension = ?

when you look at the whole system, tension cancels, so to find tension you should look at part of the system. Go over next class at the start.

Lab Activity Elastic Forces
When you pull/push on an elastic band or a spring it changes the length, L.
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Take a ruler, an elastic band (no stupid stuff) and a spring scale (force meter).

Pull the elastic band with the spring scale, record the force - graph F (y-axis) and x (x-axis). get the equation

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Force (N)	$x=L-L_o$ (cm)
0	0
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	7.0
	8.0
	9.0
	10.0

graph and get the equation
be ready to share answers to p102-107 next class

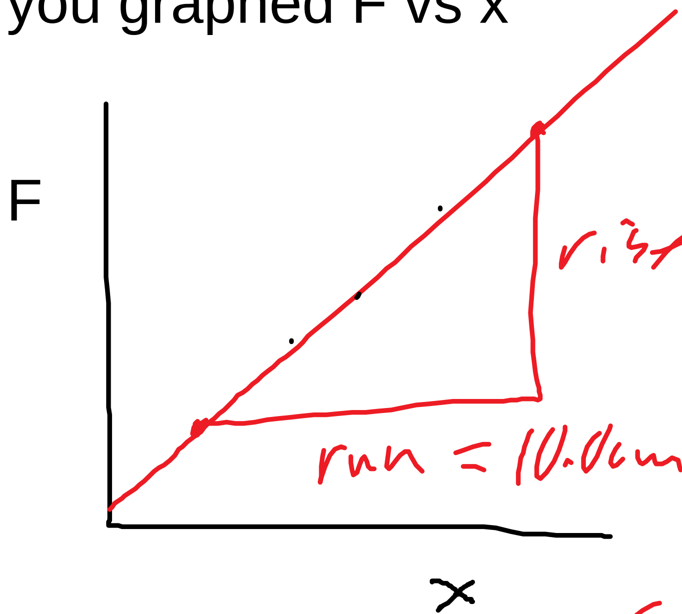
Elastic Forces today - not in book

Universal gravity Wednesday? (chap 8.1)
Group Test Friday
Individual Test Tuesday Nov 28
Momentum Thursday Nov 30 - marks

Elastic Forces:

When you pulled on the elastic band, the length of the band extended a distance, x.

you graphed F vs x



rise = 8.5N − 2.1N

run = 10.0cm − 2.0cm

$$\text{Slope} = \frac{6.4N}{8.0cm} = \boxed{0.80 \frac{N}{cm}}$$

$$\boxed{F = 0.80 \frac{N}{cm} x + 0.6N}$$

If I extend the elastic band 2.0 cm, what

force does the elastic pull with?
ignore the y - intercept F = 2x0.8=1.6 N
if we add the 0.6N offset, = 2.2N
How about 10.0 cm?
10x0.8=8 N + 0.6N = 8.6N

Hooke's Law

The elastic force is proportional to the compression or extension of an elastic object.

the force opposes x

$$\boxed{F_{elastic} = -kx}$$

$F_{elastic}$ is the force the elastic object pushes back with, in N.

k is the elastic constant, in N/m or N/cm.

x is the amount the object is compressed or stretched, in m or cm.

eg. I hang a 1.0 kg mass from
a) a spring   b) an elastic band

1. if the spring stretches _from 23.5cm to 43.0cm______ and the elastic band stretches __from 10.0cm to 22.0cm_ what is the elastic constant of each? (assume they are perfectly elastic)

b) if I pull the 1.0 kg mass down another 4.0

cm while it hangs from the spring and let go, what is the new elastic force and the acceleration of the mass?

p102-107 check answers

$F_{elastic} = F_g$ if the mass just hangs there and doesn't accelerate

$kx = mg$

$k = mg/x = 1.0 \times 9.8/(43-23.5) = 0.5026$

$\boxed{k = 0.50\ N/cm}$ for the spring

$k = mg/x = 1.0 \times 9.8/(22-10) = 0.8167$

$\boxed{k = 0.82 N/cm}$ for the elastic band

more

b) $F = kx = 0.50 N/cm \times (19.5 cm + 4.0\ cm)$

$= 0.50 \times (19.5+4) = 11.75\ N = \boxed{12 N}$

$a = F_{net}/m = (F_{elastic} - F_g)/m = (11.75-9.8)/1 = 1.95$

$\boxed{2.0 m/s^2}$

Gravity

What is gravity?

ideas:
the force pulling down?
Earth causes gravity?
How about if you are on the moon? it is less.
How much less? Why?

The moon is smaller than the Earth.
It has to do with mass and distance.

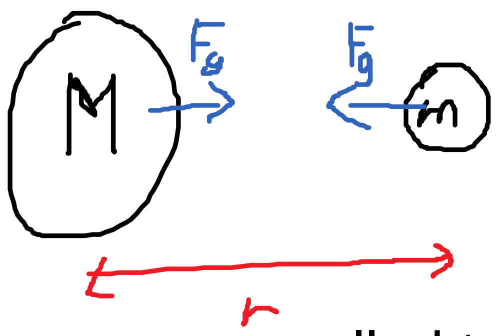
Newton's Universal gravitation theory:

Story: Newton saw an apple fall, and thought, "Is the moon pulled to the Earth as well?"

Answer is yes. And the Earth is pulled to the moon - this causes tides.

Gravity is the force pulling all masses together.
(Einstein - gravity is curvature in space-time)

Newton



Any two masses are pulled together with force, F_g.
F_g increases with mass but decreases with r.

$$\boxed{F_g = GMm/r^2}$$

where M and m are any two masses, in kg.
r is the distance between the centre of the masses in metres, m.
G is the universal gravitational constant $=6.67 \times 10^{-11} Nm^2/kg^2$ everywhere in the universe

($g=9.8$ near Earth only)

Homework
What is the force of gravity pulling

a) two students together, one 50.0 kg and one 60.0kg who are 1.5 m apart?
b) a 1.0kg mass towards the Earth, radius 6.38×10^6m with a mass of 5.98×10^{24}kg.
c) the Earth to the Sun, 1.98×10^{30}kg 1.5×10^{11}m away.
review Ch 5